MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2021/2022

PMT0101 – MATHEMATICS I

(All sections)

9 AUGUST 2022
9:00 am – 11:00 am
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 4 pages with 5 Questions only.
2. Answer **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please write all your answers in the Answer Booklet provided.

QUESTION 1 [10 marks]

a) Simplify the expression and write your final expression in term of positive exponents.

$$\frac{\left(27x^2y^{-6}\right)^{-\frac{1}{3}}}{\left(\sqrt[3]{x}y^{-1}\right)^2}$$

[2 marks]

b) Rationalize the denominator for $\frac{4}{2\sqrt{3}+4}$ and simplify. Write your final answer as $a+b\sqrt{c}$ where a, b and c are integers. [2 marks]

c) Simplify the following expression completely.

$$\frac{2x-4}{3x^3+5x^2-12x-20}$$

[3 marks]

d) Express $\frac{\sqrt{-4}}{1+\sqrt{-9}}$ in the form of complex number $a+bi$, where $a,b\in\mathbb{R}$.

[3 marks]

QUESTION 2 [10 marks]

a) Solve the following equations for x.

i. $\sqrt{6x-2}=x+1$ *Note: Verify your answer.*

ii. $\frac{1}{x-1}=\frac{2}{4x}+\frac{1}{4(x-1)}$ [5.5 marks]

b) Use *Sign Diagram* to solve the inequality $\frac{x-3}{(x+4)(x-1)}\leq 0$. Write your final answer in interval notation. [3 marks]

c) Solve the inequality $|x-3|\geq 3$. Write your final answer in interval notation.

[1.5 marks]

Continued .....

QUESTION 3 [10 marks]

a) Given the line $2x+ky+4=0$ is perpendicular to the line $5x+y-3=0$. Find the value of k. [2 marks]

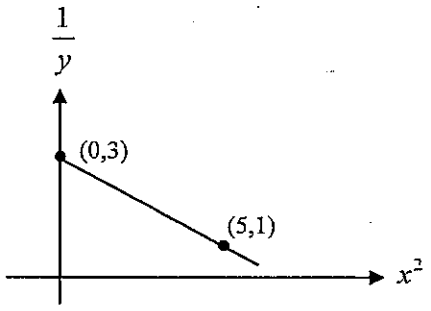
b) Given point $P(x,y)$ moves such that its distance from point $Q(2,0)$ is always twice its distance from point $R(0,1)$. Find an equation of the locus of P. Express your answer in the form, $ax^2+by^2+cx+dy+e=0$ where a, b, c, d and e are real numbers. [3 marks]

c) Given an equation of a circle $x^2+y^2-22x+8y+136=0$.

i. Use completing the square method to express the equation in the form $(x-h)^2+(y-k)^2=r^2$ where h, k and r are constants.

ii. Find the center and radius of the circle. [3 marks]

d) The relation between variables x and y is given by equation $\frac{x}{y}=2px^3+qx$, where p and q are constants. A straight line is obtained by plotting $\frac{1}{y}$ against x^2, as shown in the diagram below. Express the equation $\frac{x}{y}=2px^3+qx$ in the linear form used to obtain the straight line. Hence, find the values of p and q.



[2 marks]

Continued .....

QUESTION 4 [10 marks]

a) Determine the domain of the following functions. Write your final answer in interval notation.

i. $f(x)=\sqrt{1-3x}$

ii. $f(x)=\dfrac{2x+1}{(x-2)(x+1)}$ [2 marks]

b) Given $f(x)=\sqrt{5-3x}$ and $g(x)=x^2-\dfrac{1}{3}$. Find

i. $\left(f^{-1}\right)(x)$

ii. $(f\circ g)(x)$ [3 marks]

c) Given $4\log_{10}\left(xy^2\right)-\log_{10}x-\log_{10}y^3=2\log_{10}10$. Express y in terms of x. [2 marks]

d) Solve the following functions.

i. $\ln\dfrac{x+4}{2x}=3$

ii. $\dfrac{1}{3^{-2x}}=\dfrac{81}{27^x}$ [3 marks]

Continued .....

QUESTION 5 [10 marks]

a) Given a quadratic function $f(x)=-x^2-2x+4$.

i. Write the quadratic function in the standard form $f(x)=a(x-h)^2+k$ where a, h and k are some constants.

ii. Hence, determine the maximum or minimum value of $f(x)$. [2.5 marks]

b) Consider the polynomial function $f(x)=x^2(x+1)^2(x-1)$.

i. Determine the degree of $f(x)$.

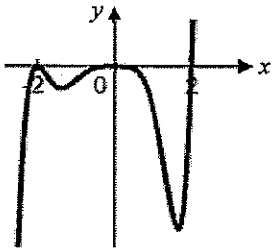
ii. Determine **the zeros** of $f(x)$ **and their multiplicities**. Then identify whether the graph of $f(x)$ crosses or touches the x-axis at each zero.

iii. Determine its x-intercept and y-intercept.

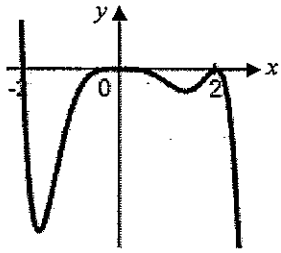
iv. Determine the end behavior of $f(x)$. [4 marks]

c) Which of the following is the graph of $y=-x^4(x+2)^2(x-2)$?

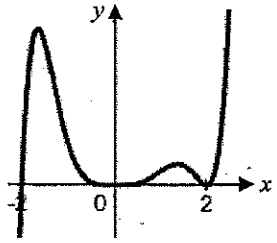
(i)



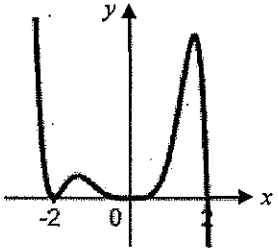
(ii)



(iii)



(iv)



[1 mark]

d) Find the quotient and the remainder of the following using long division.

$$\frac{2x^4+2x^3+x^2-x+2}{x^2+1}$$

[2.5 marks]

End of Page.